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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
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Isomaltulose containing comestibles for sustained carbohydrate energy release and reduced glycemic/insulinemic responses

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NEWPORT

**ISOMALTULOSE CONTAINING COMESTIBLES FOR SUSTAINED
CARBOHYDRATE ENERGY RELEASE AND REDUCED
GLYCEMIC/INSULINEMIC RESPONSES**

Technical Field

The present invention relates to a composition of isomaltulose and a carbohydrate selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, and mixtures thereof for sustained carbohydrate energy release in liquid, semi-solid and solid comestibles.

Background of Invention

There are a number of liquid, semi-solid and solid products currently applied for providing energy to the body.

A lot of liquid compositions or diluted mixtures are on the market by the name of 'Activity drinks', 'Sports drinks', 'Energy drinks' or 'Nutrient drinks'. These drinks are reported to meet requirements with respect to the use and/or loss of carbohydrates, electrolytes, vitamins, electrolytes, amino acids, and other important nutrients which occurs during heavy exercise.

JP01-060360A relates to an isotonic drink which is containing palatinose (= isomaltulose) as main carbohydrates.

JP63-112963A relates to food and drink which is containing palatinose as a sweetener, and/or excipient, and/or extender.

There is a further need for having compositions suitable for sustained carbohydrate energy release.

The current invention provides such a composition and products comprising this composition.

Summary of Invention

The current invention relates to a composition comprising as sustained carbohydrate energy release source a) a mixture (A) of isomaltulose and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B)

of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof.

The current invention relates to a composition which is comprising as sustained carbohydrate energy release source a mixture (A) wherein the ratio of isomaltulose to said carbohydrate (H) is from 20:80 to 70:30, or a mixture (C) containing from 20 to 70% by weight of isomaltulose.

The current invention further relates to a composition containing as said sustained carbohydrate energy release source a mixture (A) wherein the ratio of isomaltulose and said carbohydrate (H) is from 30:70 to 60:40, or a mixture (C) containing from 30 to 60% by weight isomaltulose.

The current invention further relates to a solid, semi-solid or liquid comestible wherein at least 5% of aforementioned composition (based on dry matter of comestible) is present. Preferably said composition represents more than 10% of dry substance of the comestible.

Said comestible is selected from the group consisting of tablets, bars, confectionery, beverages, beverage concentrates, gels, drink powders, diabetic food, baby food, infant food, dietetic food, slimming food, food for special dietary needs and medical food.

Furthermore, the current invention relates to a beverage selected from the group consisting of hypotonic drinks, soft drinks, sports drinks, hypertonic drinks, energy drinks and isotonic drinks. The beverage further can comprise other carbohydrates, proteins, peptides, amino acids, antioxidants, fats, vitamins, trace elements, electrolytes, intense sweeteners, edible acids, flavors and/or mixtures thereof. These carbohydrates are selected from the group consisting of monosaccharides, disaccharides, gelling starches, starch hydrolysates, dextrins, polyols and mixtures thereof. The dry substance of said carbohydrates in the beverage is comprising at least 50% of a composition comprising as sustained carbohydrate energy release source a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and

mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof.

The current invention further relates to the use of a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, for sustained carbohydrate energy release in athletics food, dietetic food, slimming food, food for special dietary needs, diabetics food, baby food, infant food, food for elderly, and medical food.

Furthermore, the current invention relates to the use of a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, for modified perception of satiety or hunger.

Detailed Invention

The current invention relates to a composition comprising as sustained carbohydrate energy release source a) a mixture (A) of isomaltulose and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof.

It relates further to a composition which is comprising as sustained carbohydrate energy release source a mixture (A) wherein the ratio of isomaltulose to said carbohydrate (H) is from 20:80 to 70:30, or a mixture (C) containing from 20 to 70% by weight of isomaltulose. Furthermore it relates to a composition containing as said sustained carbohydrate energy release source a mixture (A) wherein the ratio of isomaltulose and said carbohydrate (H) is from 30:70 to 60:40, or a mixture (C) containing from 30 to 60% by weight isomaltulose.

Isomaltulose or 6-O- α -D-glucopyranosyl-D-fructofuranose is synthesised from sucrose by the action of an enzyme present in bacterial strains like *Protaminobacter rubrum*, *Erwinia rhamphontici* and *Serratia plymuthica*.

Fructose syrups cover all syrups containing on dry substance from 42 to 100% fructose. An example of a fructose syrup can be high fructose corn syrup which is containing from 42-55% fructose.

The intense sweeteners include, but are not limited to, saccharin, cyclamates, acetosulfam, aspartame and the like. The mixture is comprising at least one intense sweetener, and mixtures of intense sweeteners can be included as well.

The polyol is can be selected from tetritols, pentitols, hexitols, and higher polyols. The polyol is including but not limited to erythritol, xylitol, arabinitol, sorbitol, mannitol, iditol, galactitol, maltitol, isomaltitol, isomalt, lactitol, mixtures thereof and the like.

The composition is particular useful for providing carbohydrate energy over a long period, while the composition is digestible and absorbable.

The current invention further relates to a solid, semi-solid or liquid comestible wherein based on dry matter of comestible at least 5% of aforementioned composition is present. Preferably said composition represents more than 10% of dry substance of the comestible.

Said comestible is selected from the group consisting of tablets, bars, confectionery, beverages, beverage concentrates, gels, drink powders, diabetics food, baby food, infant food, dietetic food, slimming food, food for special dietary needs, and medical food.

Tablets can be based solely upon the composition with mixture (A) containing isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol and mixtures thereof, for obtaining sustained carbohydrate energy release, or the composition with mixture (B) containing isomaltulose and at least one intense sweetener, or the composition (C) containing isomaltulose, at least one intense sweetener, and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol and mixtures thereof. The diabetic food, baby food, infant food, dietetic food, slimming food, food for special dietary needs refer to any type of food suitable for diabetics, babies, infants and people needing a special dietetic formulation and any one who can benefit from the presence of a sustained carbohydrate energy release source, and those who can benefit from a modified perception or satiety or hunger.

Medical food refers to any liquid, semi-solid or liquid comestible which is given to people in medical need for having access to extra sustained carbohydrate energy source, e.g. people with heavy burns and/or scalds.

The beverage can be any drinkable solution including iced tea, and fruit juices, vegetable based juices, lemonades, cordials, nut based drinks, cocoa based drinks, dairy products such as milk, whey, yogurts and drinks based on them.

Beverage concentrate refers to a concentrate that is either in liquid form or in essentially dry mixture form. The liquid concentrate can be in the form of a relatively thick, syrupy liquid. The essentially dry mixture can be in the form of either a powder or a tablet. The beverage concentrate is usually formulated to provide a drinkable beverage composition or a final beverage when constituted or diluted with water, either carbonated or non-carbonated.

Drink powders are suitable for constituting with water, carbonated or non-carbonated, a final beverage for oral administration of sustained energy release source of current invention.

Furthermore, the current invention relates to a beverage selected from the group consisting of hypotonic drinks, soft drinks, sports drinks, hypertonic drinks, energy drinks and isotonic drinks.

A specific example of a hypotonic drink is a rehydration drink.

In general, the beverage can further be characterized in having an osmolality of from 50 to 800 mOs/L, preferably from 150 to 600 mOs/L, more preferably from 200 to 400 mOs/L.

An isotonic drink is typically characterized by an osmolality of from 270 – 330 mOs/L.

The beverage further can comprise other carbohydrates, proteins, peptides, amino acids, antioxidants, fats, vitamins, trace elements, electrolytes, intense sweeteners, edible acids, flavors and/or mixtures thereof.

The carbohydrates are selected from the group consisting of monosaccharides, disaccharides, gelling starches, starch hydrolysates, dextrans, polyols and mixtures thereof, whereby these carbohydrates are different from said carbohydrate and isomaltulose mentioned in the composition of current invention.

The monosaccharides include tetroses, pentoses, hexoses and ketohexoses.

Starch hydrolysates are produced by the controlled acid or enzymatic hydrolysis of starch and can be subdivided into two specific categories, maltodextrins and glucose syrups and are characterized by DE number (dextrose equivalent). In fact, DE number is a measurement of the percentage of reducing sugars present in the syrup and calculated as dextrose on a dry weight basis. Maltodextrins have a DE number up to 20 whereas glucose syrups have an DE number greater than 20.

Dextrins are prepared according to the dextrinisation method. Dextrinisation is a heat treatment of dry starch in presence or absence of acid.

Gelly starches may include emulsified starches such as starch n-octenyl succinate.

Preferably the dry matter content of the carbohydrates present in the beverage is comprising at least 50% of a composition containing a) a mixture

(A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof. In fact, it is further possible having beverages wherein the dry matter content of the carbohydrates is based 100% upon the composition of the current invention, i.e. composition containing a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof. It further relates to beverages wherein these compositions are comprising a mixture (A) wherein the ratio of isomaltulose and said carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol and mixtures thereof, is from 20:80 to 70:30, or a mixture (C) wherein from 20 to 70% by weight of isomaltulose is present.

Among the major physiological electrolytes are sodium, potassium, chloride, calcium, and magnesium. Further trace elements can be included such as chromium, copper, selenium, iron, manganese, molybdenum, zinc and mixtures thereof.

Among the vitamins one can range vitamin A, vitamin C, vitamin E and/or vitamin B₁₂.

The edible acids can be selected from phosphoric acid, citric acid, malic acid, succinic acid, adipic acid, gluconic acid, tartaric acid, fumaric acid and mixtures thereof. Preferably the pH range of the beverage is from about 2 to about 6.5.

The flavors are selected from fruit flavors, botanical flavors and mixtures thereof. Preferred flavors are cola flavor, grape flavor, cherry flavor, apple

flavor and citrus flavors such as orange flavor, lemon flavor, lime flavor, fruit punch and mixtures thereof. The amount of flavor depends upon the flavor or flavors selected, the flavor impression desired and the form of flavor used.

If desired, coloring agents can also be added. Any soluble coloring agent approved for food use can be utilized for the current invention.

When desired, preservatives such as potassium sorbate and sodium benzoate can be added.

Gums, emulsifiers and oils can also be added in the beverage for texture and opacity purposes. Typical ingredients include guar gum, xanthan gum, alginates, carboxymethylcellulose, mono-di-glycerides, lecithin, gelling starches, pectin, pulp, cotton seed oil and vegetable oil.

The beverage may be prepared by mixing together all of the ingredients. The mixture is then dissolved in water and agitated until all the ingredients are dissolved. Dissolution may occur at ambient temperature but it may be necessary for the solution to be heated to temperature between 50-100°C to get all the ingredients into solution. After the mixture having been adjusted to a desired pH, the beverage may be bottled, capped, and eventually pasteurized at about 75°C for about 20 minutes, or the beverage may be before bottling continuously pasteurized for a few minutes.

One way to prepare the concentrate of the beverage would be to start with less than the required volume of the liquid solvent that is used to prepare the drinkable beverage. Another way would be to partially dehydrate the finally prepared drinkable beverage to remove only a portion of the liquid solvent and any other volatile liquid present.

Carbon dioxide can be introduced either into the water to be mixed with the beverage concentrate or into the drinkable beverage to achieve carbonation. The carbonated beverage can then be stored in a container, such as a bottle or a can and then be sealed.

The current invention further relates to the use of a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a

mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, for sustained carbohydrate energy release in athletics food, dietetic food, food for special dietary needs, diabetics food, baby food, infant food, food for elderly and medical food.

Furthermore, the current invention relates to the use of a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, to modify perception of satiety or hunger.

The current invention has the following advantages:

- The composition comprising either a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof, is a suitable source of sustained carbohydrate energy release.
- Said composition is digestible and absorbable.
- The composition can be applied in solid, semi-solid and liquid comestibles.
- The comestible is suitable for athletics, diabetics, babies, infants, elderly people and those requiring a special diet in respect of sustained carbohydrate energy release.
- The comestible is suitable for people following a slimming diet due to the modified perception of satiety or hunger.

The current invention is illustrated by way of the following examples.

Example 1

The basic syrup was prepared with the following ingredients:

202 g isomaltulose

389 g fructose

5 ml sodium benzoate 10% (w/v)

3 ml phosphoric acid 85%

15 g cola flavor Wild (nr 35103000170000)

carbonated water was added for obtaining 1 liter basic syrup.

42 ml of this basic syrup was placed in a bottle and further diluted with carbonated water to a final volume of 210 ml.

The taste was evaluated with a taste panel.

A good cola perception was found, comparable to a standard drink prepared with 534 g sucrose.

Example 2

The basic syrup was prepared with:

306 g isomaltulose

290 g fructose

5 ml sodium benzoate 10% (w/v)

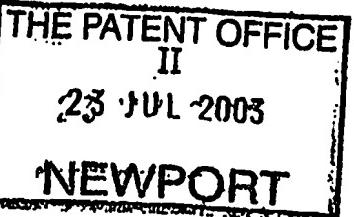
2.6 ml phosphoric acid 85%

15 cola flavor Wild (nr 35103000170000)

+ carbonated water until 1 Liter

42 ml of this basic syrup was diluted with carbonated water until a final volume of 210 ml.

The taste was again evaluated by a taste panel and was considered as an acceptable formulation.

CLAIMS

1. Composition comprising as sustained carbohydrate energy release source:
 - a) a mixture (A) of isomaltulose and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof,
 - b) a mixture (B) of isomaltulose and at least one intense sweetener, or
 - c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof.
2. A composition according to claim 1 characterized in that said sustained carbohydrate energy release source is a mixture (A) wherein the ratio of isomaltulose and carbohydrate (H) is from 20:80 to 70:30, or a mixture (C) containing from 20 to 70% by weight of isomaltulose.
3. A composition according to claim 1 or 2 characterized in that said sustained carbohydrate energy release source is a mixture (A) wherein the ratio of isomaltulose and said carbohydrate (H) is from 30:70 to 60:40, or a mixture (C) containing from 30 to 60% by weight isomaltulose.
4. A solid, semi-solid or liquid comestible characterized in that dry matter of comestible is comprising at least 5% of a composition containing:
 - a) a mixture (A) of isomaltulose and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof,
 - b) a mixture (B) of isomaltulose and at least one intense sweetener, or

- c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol and mixtures thereof.
5. A comestible according to claim 4 characterized in that said composition is containing a mixture (A) wherein the ratio of isomaltulose to carbohydrate (H) is from 20:80 to 70:30, or a mixture (C) wherein from 20 to 70% by weight isomaltulose is present.
6. A comestible according to claim 4 characterized in that dry matter of comestible is comprising more than 10% of a composition containing:
- a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof,
 - b) a mixture (B) of isomaltulose and at least one intense sweetener, or
 - c) a mixture (C) of isomaltulose, at least one intense sweetener and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof.
7. A comestible according to anyone of claim 4 to 6 characterized in that said comestible is selected from the group consisting of tablets, bars, confectionery, beverages, beverage concentrates, gels, drink powders, diabetic food, baby food, infant food, dietetic food, slimming food, food for special dietary needs, and medical food.
8. A beverage according to claim 7 characterized in that said beverage is selected from the group consisting of hypotonic drinks, soft drinks, sports drinks, hypertonic drinks, energy drinks, and isotonic drinks.

9. A beverage according to claim 8 characterized in that it is further comprising carbohydrates, proteins, peptides, amino acids, antioxidants, fats, vitamins, trace elements, electrolytes, intense sweeteners, edible acids, flavors and/or mixtures thereof.
10. A beverage according to claim 9 characterized in that said carbohydrates are selected from the group consisting of monosaccharides, disaccharides, gelling starches, starch hydrolysates, dextrins, polyols and mixtures thereof.
11. A beverage according to claim 10 characterized in that dry substance of said carbohydrates in said beverage is comprising at least 50% of a composition containing:
 - a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol and mixtures thereof,
 - b) a mixture (B) of isomaltulose and at least one intense sweetener, or
 - c) a mixture (C) of isomaltulose, at least one intense sweetener and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof
12. Use of
 - a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof,
 - b) a mixture (B) of isomaltulose and at least one intense sweetener, or
 - c) a mixture (C) of isomaltulose, at least one intense sweetener and carbohydrate (H) selected from the group consisting of

fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof,

for sustained carbohydrate energy release in athletics food, dietetic food, food for special dietary needs, slimming food, diabetics food, baby food, infant food and food for elderly, and medical food.

13. Use of

- a) a mixture (A) of isomaltulose and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof,
- b) a mixture (B) of isomaltulose and at least one intense sweetener, or
- c) a mixture (C) of isomaltulose, at least one intense sweetener and carbohydrate (H) selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof,

to modify perception of satiety or hunger.

THE PATENT OFFICE
II
23 JUL 2003

15

ABSTRACT

NEWPORT

The current invention relates to a composition comprising as sustained carbohydrate energy release source a) a mixture (A) of isomaltulose and carbohydrate selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof; or b) a mixture (B) of isomaltulose and at least one intense sweetener, or c) a mixture (C) of isomaltulose, at least one intense sweetener and a carbohydrate selected from the group consisting of fructose, fructose syrups, sucrose, invert sugar, polyol, and mixtures thereof. This composition is applied in solid, semi-solid and liquid comestibles.

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